

US ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SPD-02513
Sep 85
Revised Apr 89

TO: Architect-Engineers and District Personnel:

1. The attached revised guide specification supercedes the previous guide,
BITUMINOUS COURSE (CENTRAL-PLANT HOT MIX), SPD-2A, dated September 1985,
and is
for use in the preparation of project specifications.

TEXT REVISION

Para 1

NOTE: A-E's should read all the TECHNICAL NOTES located at the beginning of this guide specification and edit the specification accordingly.

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GENERAL NOTES

1. This guide specification is to be used in the preparation of contract specifications in accordance with the Sacramento District Specification Manual. It will not be made a part of a contract merely by reference; pertinent portions will be copied verbatim into the contract documents.
2. Where numbers, symbols, words, phrases, clauses, or sentences in this specification are enclosed in the following manner: [], a choice or modification must be made; delete inapplicable portion(s) carefully. Where blank spaces occur in sentences, insert the appropriate data. Where entire paragraphs are not applicable, they should be deleted completely.

TECHNICAL NOTES

- A. This specification describes a bituminous course that can be used for leveling, feathering, and for wearing course construction. It will be used for roads, streets, open storage areas, sidewalks, and airfield pavements for up to 100 p.s.i. tire pressure and for a design index of six or below. Instructions for the use of this or other paving guide specifications are contained in the Geotechnical Report (appendix to design analysis) for each project.
- B. The section number will be inserted in the specification heading and prefixed to each page number in project specifications.
- C. Paragraph 1: The listed designations for publications are those that were in effect when this guide specification was being prepared. These designations are updated when necessary by District Instruction, and references in project specifications need be no later than in the current District Instruction for this guide specification. To minimize the possibility of error, the letter suffixes, amendments, and dates indicating specific issues should be retained in Paragraph 1 and omitted elsewhere in the project specification.
- D. Paragraph 2: When applicable, change the end of the first sentence to ". . . . and compacted on an existing pavement surface" or add to the sentence ". . . . or compacted on an existing pavement surface."

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E. Paragraph 4:

a. For Arizona and Utah, asphalt concrete is viscosity grades by AC, thus Table 2 is used. Insert a 2 and remove the parenthesis.

For California and Nevada, asphalt concrete is viscosity graded by AR, thus Table 3 is used. Insert a 3 and remove the parenthesis.

b. The viscosity grade shall be as stated in the Geotechnical Report. For Arizona and Utah, the viscosity grade will be either AC-5, AC-10 or AC-20. For California and Nevada, the viscosity grade shall be either AR-1000, AR-2000, AR-4000, AR-8000, or AR-16000. Insert the value listed in the Geotechnical Report and remove brackets.

c. Delete the second sentence and remove the brackets around the first sentence, unless instructed otherwise in the Geotechnical Report. The second sentence will apply only to certain heavy duty pavements or areas of severe climate. If the second sentence is used, the penetration range will be provided in the Geotechnical Report.

d. Use of a viscosity grade (as presently shown in paragraph 4 of text), a penetration grade (shown below), or the option for either one will be called for in the Geotechnical Report (appendix to design analysis).

PENETRATION GRADE ONLY

"4. BITUMINOUS MATERIAL: Bituminous material to be mixed with the mineral aggregates shall be asphalt cement conforming to ASTM C 946, penetration range [60-70] [85-100] [120-150]. Asphalt cement after exposure in thin films in accordance with AASHTO T 179 shall have a penetration of not less than [42%] [45%] [50%] of the original penetration for range [60-70] [85-100] [120-150]. In addition, after such exposure, the ductility of the asphalt residue when tested in accordance with ASTM D 113 shall be not less than 100 centimeters."

PENETRATION OR VISCOSITY GRADES

"4. BITUMINOUS MATERIAL: Bituminous material to be mixed with the mineral aggregates shall be asphalt cement conforming to either one of the following:

4.1 Penetration Grade: ASTM D 946, penetration range . . . (continue as per

paragraph 4 above).

4.2 Viscosity Grade: ASTM C 3381, Viscosity-graded . . . (continue as per paragraph 4 in text).

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e. The penetration range and/or viscosity grade for a given project will be specified in the Geotechnical Report (appendix to design analysis). Delete all other inapplicable numbers and remove the brackets. The percentages shown for the penetration grades are in the same relative order as the grades.

F. Paragraph 5: Insert the appropriate gradation(s) from the chart below, and/or as required by the Geotechnical Report furnished by the District as an appendix to the the Architect-Engineer design analysis. Delete the brackets around "one of" or delete the phase altogether, depending on whether one or two gradations are specified.

PERCENT PASSING BY WEIGHT

Sieve Size	Arizona		California		Nevada		Utah		Sieve Size
	a	b	a	b	a	b	a	b	
1"	100	100	100	-	100	100	100	-	1"
3/4"	90-100	90-100	90-100	100	90-100	90-100	-	100	3/4"
1/2"	-	-	-	95-100	-	-	70-90	-	1/2"
3/8"	55-80	65-90	60-75	75-90	55-85	63-85	-	69-91	3/8"
#4	-	-	40-55	50-66	40-66	45-65	43-57	42-58	#4
#8	20-45	35-60	27-41	35-50	-	-	-	-	#8
#16	-	-	-	15-40	20-40	19-29	17-31		#16
#30	-	-	10-23	15-30	-	-	-	-	#30
#50	-	-	-	-	-	10-20	9-21		#50
#200	2-6	2-8	3-7	3-7	3-9	3-9	4-8	4-8	#200

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- G. Paragraph 10: Delete the reference to base course or to existing pavement, if not applicable.
- H. Paragraph 11: When the bituminous course is placed on an existing pavement, the paragraph should be modified to include the requirements for special preparation and repair (if required) of the existing surface. Delete the reference to prime or tack coat, as applicable, and remove all brackets.

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SECTION 02513

BITUMINOUS COURSE (CENTRAL-PLANT HOT MIX)

1. APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 American Society for Testing and Materials (ASTM):

C 117-87	Materials Finer Than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.
C 127-84	Specific Gravity and Absorption of Coarse Aggregate.
C 128-84	Specific Gravity and Absorption of Fine Aggregate.
C 136-84a	Sieve Analysis of Fine and Coarse Aggregates.
D 5-86	Penetration of Bituminous Materials.
D 242-85	Mineral Filler for Bituminous Paving Mixtures.
D 1559-82	Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
D 3381-83	Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

2. GENERAL: Bituminous course shall consist of fine and coarse aggregates and mineral filler, if required, uniformly mixed with bituminous material, and placed and compacted on a prepared base course. This specification allows the use of a state highway aggregate gradation.

3. AGGREGATES: Aggregates shall consist of crushed stone, crushed slag, or crushed gravel, screenings, sand, and mineral filler. Aggregates shall have a satisfactory service record in bituminous pavement construction, and the source selected shall be approved by the Contracting Officer. Not less than 50 percent by weight of the aggregates retained on the No. 4 sieve shall have at

least two fractured faces. Material passing the No. 200 sieve shall be known as mineral filler, and shall conform to ASTM D 242. The combined aggregates and mineral filler shall meet the requirements of subsequent paragraphs entitled AGGREGATE GRADATION and COMPOSITION OF MIXTURE.

4. BITUMINOUS MATERIAL: Bituminous material to be mixed with the mineral aggregates shall be paving asphalt conforming to ASTM D 3381, Viscosity-Graded Asphalt Cement for Use in Pavement Construction as listed in Table of the ASTM Standard D 3381, Requirements for Asphalt Cement Viscosity-Graded at 140/F (60/C). Paving asphalt viscosity grade shall be . [Certified results of tests conducted in accordance with ASTM D 5 shall be submitted in advance of any paving, showing the penetration at 25/C (77/F.) for the AR grades of asphalt that will actually be used in the paving mix of this project.] [In addition, the penetration range at 25/C. (77/F) shall be .]

5. AGGREGATE GRADATION: The aggregate gradation as described by ASTM C 117 and C 136 shall fall within the limits of the following:

Sieve Openings	Percentage by Weight, Passing
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6. COMPOSITION OF MIXTURE:

6.1 Job-Mix formula shall be submitted by the Contractor, and no bituminous mixture shall be manufactured until it has been approved by the Contracting Officer. The formula shall indicate the percentage and specific gravity of each bin fraction of aggregate, percentage absorption and specific gravity of asphalt, temperature of the mixture as discharged from the mixer; and test results which show that the job mix formula will produce a bituminous mixture which meets all requirements of this specification. Previously established test results will be acceptable provided that the tests were performed within the last six months. The asphalt in the job-mix formula shall be between 4.5% and 7.5% of the weight of the total mix. If requested by the Contracting Officer, samples of the aggregates and asphalt shall be submitted for approval of the job-mix formula.

6.2 Test Properties of Bituminous Mixtures:

6.2.1 For Nonabsorptive Aggregate: When the water absorption value of the entire blend of aggregate does not exceed 2.5 percent as determined by ASTM C 127 and C 128, aggregate is designated as nonabsorptive. The apparent specific gravity shall be used in computing the voids total mix and voids

filled with bitumen. Stability and flow shall be determined in accordance with ASTM D 1559. The mixture shall meet the requirements of Table 1 herein.

TABLE 1. NONABSORPTIVE AGGREGATE MIXTURE

Test Property	50-Blow Compaction
Stability, minimum, pounds	1000
Flow, 1/100-inch units	8 minimum, 20 maximum
Voids total mix, percent	3-5
Voids filled with bitumen, percent	75-85

6.2.2 For Absorptive Aggregate: When the water absorption value of the entire blend of aggregate exceeds 2.5 percent as determined in ASTM C 127 and C 128, the aggregate is designated as absorptive. Bulk-impregnated specific gravity shall be used in computing the percentages of voids total mix and voids filled with bitumen. Stability and flow shall be determined in accordance with ASTM D 1559. The mixture shall meet the requirements in Table 2, herein.

TABLE 2. ABSORPTIVE AGGREGATE MIXTURE

Test Property	50-Blow Compaction
Stability, minimum, pounds	1000
Flow, 1/100-inch units	8 minimum, 20 maximum
Voids total mix, percent	2-4
Voids filled with bitumen, percent	80-90

6.3 Stripping of Aggregates: After 24 hours immersion in water bath controlled at a temperature of 140/ F. + 1/, the retained stability of job-mix formula test specimens shall be at least 75 percent of the stability of companion specimens prepared for the job-mix formula when tested in accordance with ASTM D 1559. If the retained stability is less than the required 75 percent, the aggregates shall be either rejected or treated by one of the following procedures until the retained stability reaches the required 75 percent:

- (1) Addition of heat-stable additives to bitumen;
- (2) addition of hydrated lime, or other cementitious material containing free lime, as a portion of the mineral filler.

7. SAMPLING AND TESTING: All samples and control testing for construction of the pavement shall be performed by the Contractor in accordance with the

Construction Control Manual. The type and size of the samples shall be suitable to determine conformance with stability, density, thickness and other specified requirements. An approved powersaw or core drill shall be used for cutting samples. The Contractor shall furnish all tools, labor, and materials for cutting samples, testing, and replacing the pavement where samples were

removed, to the satisfaction of the Contracting Officer. No payment will be made for areas of pavement deficient in composition, density, or thickness until they are removed and replaced by the Contractor as directed by the Contracting Officer.

8. MIXING PLANT: Mixing plant shall be a weigh-batch, continuous-mix type or dryer drum type and operated so as to produce a mixture within the job-mix formula.

9. OTHER EQUIPMENT:

9.1 Bituminous-materials spreaders shall be self-propelled, capable of producing a finished surface conforming to the smoothness requirements specified hereinafter. The use of a spreader that leaves indentations or other objectionable irregularities in the freshly-laid mix is not permitted.

9.2 Blowers and brooms shall be of the power type suitable for cleaning the surface to be paved.

9.3 Saw: Saws shall be of the power type, capable of rapidly cutting pavement and trimming joints and edges of pavement.

9.4 Small Tools: Small tools available on the work shall consist of the following: rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heater for heating small tools, wood sandles and stilt sandals of standard type, and other small tools as may be required. A sufficient number shall be available at all times. The lutes shall be constructed of metal and shall consist of a plate or sheet 36 x 4 inches attached to a handle properly braced. Hand tampers shall weigh not less than 25 pounds and have a tamping face not larger than 50 square inches.

9.5 Rollers: The minimum number of rollers for each spreader shall be one 3-wheel roller, one 2-axle tandem roller and one pneumatic-tired roller, with separate operator for each roller. For projects involving less than 200 tons of asphalt mixture the requirement for rollers may be reduced to one 2-axle tandem roller and one pneumatic-tired roller at the discretion of the Contracting Officer.

9.5.1 Steel-wheel rollers shall be self-propelled, 3-wheel (tricycle) roller and 2-axle tandem roller weighing not less than 10 tons. The rollers shall have adjustable wheel scrapers, water tanks, and sprinkling apparatus to keep the wheels sufficiently wet to prevent the bituminous mixture from sticking to the wheels. The rollers shall be capable of reversing without backlash and shall be free from worn parts. The roller wheels shall not have flat or pitted

areas or projections that will leave marks in the pavement.

9.5.2 Pneumatic-tired rollers shall be self-propelled and shall consist of two axles on which are mounted multiple pneumatic-tired wheels in such manner that the rear group of wheels will not follow in the tracks of the forward group but spaced to give essentially uniform coverage with each pass. Axles

shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. Tires shall be smooth and capable of being inflated to at least 90 p.s.i. Construction of roller shall be such that each wheel can be loaded to a minimum of 4,500 pounds.

10. WEATHER LIMITATIONS: Bituminous course shall be constructed only when base course and existing pavement is dry and when weather is not rainy. Unless otherwise directed, bituminous course shall not be constructed when temperature of the surface of existing pavement or base course is below 40/ F.

11. TREATMENT OF UNDERLYING SURFACE: Prior to laying a bituminous course, the underlying surface shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, and hand brooms, as directed. The surface to be paved shall receive a [prime coat] [tack coat] conforming to Section: BITUMINOUS [PRIME] [TACK] COAT.

12. MIXING: Temperature of asphalt at time of mixing shall not exceed 325/F. Temperature of aggregate and mineral filler in mixer shall not exceed 325/F. when asphalt is added.

13. TRANSPORTATION OF BITUMINOUS MIXTURE: The bituminous mixture shall be transported from the mixing plant to the site in trucks having tight, clean, smooth bodies with a minimum coating of concentrated solution of hydrated lime and water to prevent adhesion of the mixture. Each load of mixture shall be covered with canvas or other suitable material to protect the mixture from the weather and to prevent loss of heat. Mixtures having temperatures greater than 325/F., mixtures having temperatures less than 245/F., or mixtures which foam or show indications of moisture will be rejected. Hauling over freshly laid material is not permitted.

14. PLACING: Contact surfaces of previously constructed pavement, curbs, manholes, or other structures shall be sprayed with a thin coat of bituminous tack coat. The mechanical spreader shall be adjusted and its speed regulated so that the course being placed will be smooth and continuous without tears and pulling. The course will be of such depth that after compaction, the cross section, grade, and contour will be as shown on the drawings. In areas where the use of machine spreading is impractical, the mixture shall be spread by hand. Unless otherwise directed, placing shall begin on the high side of areas with a one-way slope or along the centerline of areas with a crowned section and shall be in the direction of the main traffic flow. Placing of the mixture shall be as continuous as possible, and the speed of placing shall be adjusted to permit proper rolling.

15. COMPACTION OF ASPHALT MIXTURE: Compaction of asphalt mixture shall be

accomplished by the steel wheel rollers and pneumatic-tired roller specified above.

15.1 Rolling shall begin as soon after placing as the mixture will support the roller without undue displacement. Breakdown rolling shall consist of at least three coverages of a layer of asphalt mixture with a steel wheel roller,

immediately followed by at least three coverages with a pneumatic-tired roller. A coverage is defined to be as many passes in either direction as may be necessary to cover the entire width of lane with overlap between passes. Each layer shall be additionally compacted by a final rolling of not less than one coverage with a 2-axle tandem roller. The speed of the rollers shall not exceed 3 miles per hour and rolling shall be performed in such a manner to avoid cracking, shoving, or displacement of the hot mixture.

15.2 The bituminous mixture shall be compacted to at least 95 percent of the density of the laboratory specimen of the same mixture subjected to 50 blows of a standard Marshall hammer on each side of the specimen. In areas not accessible to the roller the mixture shall be compacted with hot hand tampers. The compacted surface shall be smooth and free from roller marks, ruts, humps, depressions, or irregularities.

15.3 Use of vibratory steel wheel roller for breakdown and finish rolling is subject to prior approval. Vibratory roller shall be operated with the vibratory units off for finish rolling. The maximum weight of the vibratory roller shall not exceed 5 tons.

15.4 Maximum compacted thickness per lift shall be not more than 2.5 inches.

16. JOINTS AND EDGES:

16.1 General: Joints between old and new pavements or between successive day's work, or joints that have become cold because of delay, shall be made carefully to insure continuous bond between old and new sections of course. All joints shall have the same texture, density, and smoothness as other sections of course. Contact surfaces of previously constructed pavements that have become coated with dust, sand or other objectionable material shall be cleaned by brushing or cut back with approved power saw, as directed. The surface against which new material is placed shall be sprayed with a thin, uniform coat of bituminous tack coat.

16.2 Transverse Joints: The roller shall pass over the unprotected end of freshly placed mixture only when placing of course is discontinued or when delivery of mixture is interrupted to the extent that unrolled material may become cold. In all cases, edge of the previously placed course shall be sawn back to expose an even, vertical surface the full thickness of the course.

16.3 Longitudinal Joints: Edges of previously placed strip that have cooled or are irregular, honeycombed, poorly compacted, damaged, or otherwise defective, and unsatisfactory sections of the joint shall be sawn back to expose clean, sound surface for full thickness of the course as directed.

16.4 Edges of pavement adjacent to shoulders shall be trimmed neatly to line. An earth berm of selected material not less than one foot wide shall be placed against and to the full height of the pavement surface as soon as practicable after final rolling has been completed and pavement has sufficiently hardened.

17. PROTECTION OF PAVEMENT: No vehicular traffic shall be permitted on the pavement for at least 6 hours after final rolling.

18. SURFACE REQUIREMENTS: The finished surface shall not vary more than 1/4-inch from a 10-foot straightedge. The straightedge shall be furnished by the Contractor. Defective areas shall be corrected by and at the expense of the Contractor. Straightedge testing shall be performed as a Contractor Quality Control requirement to demonstrate compliance.

19. CONSTRUCTION QUALITY CONTROL: Attention is directed to SECTION: CONSTRUCTION QUALITY CONTROL which requires the Contractor to perform quality control inspection, testing, and reporting.

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- REMINDER -

Located at the front of these specifications are the Contract Clauses, Special Clauses and Division I GENERAL REQUIREMENTS of the Technical Specifications, which apply to every aspect of this contract including the work in this section whether performed by Prime Contractor, subcontractor, or supplier.